AVIATION

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Martin Bomber towing Aerial Target

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NUMBER 13

SPECIAL FEATURES

THE AERIAL MERCURY

N.A.A. NATIONAL AIR POLICY

NEW AIR BALANCE AND SMALL WIND TUNNEL

THE CALCULATION OF LONGITUDINAL STABILITY

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Amateur versus Professional Pilots

THE salary of a professional pilot is usually so large that it is necessary to carry a very considerable pay load and also to use the machine intensively, otherwise the cost per revenue mile of operation of a plane mounts up to a very unsatisfactory figure. The same is true in other fields where professionals have to be hired, there the cost of operation also goes up. If only professionals drove automobiles, there would not be a fraction of the number now used.

From the manufacturer's point of view the building of planes for professional pilots has a distinctly limited field. If the Air Mail continued running on its present scale it would probably not need for replacement more than ten or fifteen modern planes a year. Even looking forward to a vast expansion of aerial transportation, it may be many years before the requirements for this work become as large as of those of the Army and Navy. The manufacturer's field for planes piloted by professionals but used in special lines such as aerial photography, passenger carrying, cotton dusting, taxi service, fire patrol, etc. will probably enlarge in the near future, but even these fields will only need a limited number of planes.

If one can judge from the automobile and motor boat industries, the largest potential field for planes is the amateur user who does not expect to earn his living out of flying but uses his plane incidentally, either for pleasure or as a convenience in his business. At the present time there are few amateur fliers that is men who have not or do not wish to make money out of aviation. As a rule the high cost of flying and the lack of landing facilities are given as the cause. These are undoubtedly the main deterrents but there is another which has been considerably neglected.

The present day plane is designed for the professional and the plane that is suitable for the professional is not necessarily suitable for the amateur. The professional wants all kinds of instruments which the amateur would not be able to understand, much less use, and above all the professional wants maneuverability. He, also, wants a plane which will respond immediately to his slightest control whether he is flying level or in the most complicated maneuver. To get this maneuverability, the stability of the airplane must be sacrificed. A plane which follows the pilot's slightest whim, must of necessity stall, spin, side slip, nose dive, etc. In the hands of a professional, these qualities tend toward safety. When the test pilot tests a new plane he reports on it favorably or unfavorably depending on whether or not it has these qualities.

The professional pilot does not realize that the qualities which mean safety to him may mean danger to the amateur and the designer of the plane usually takes the professional's word. The amateur can not side slip to within a few feet of the ground so as to make a slow landing on a small field. Ability to stall is a danger to the amateur. A machine where a slight twist of the wrist will put it in any position is not ideal for the amateur. A certain degree of inherent stability will probably make a safer machine for the amateur than the highly maneuverable machine, which will do stunts that the amateur can not use.

It is difficult for the professional pilot to realise the limitations of the amateur pilot but the subject is of sufficient importance to warrant real study, for until a plane is built which is safe for the amateur there will only be a limited market for specialized planes.

Secretary Daniels a Little Late

THE most surprising convert to the supremacy of air power, but one none the less welcome, is Josephus Daniels, Secretary of the Navy during the War, and for eight years under President Wilson. He writes, "The imperative mandate to the American people is to concentrate in the air. If airplanes cannot sink dreadnaughts today, it is only a question of time when they can. We shall in our day see it 'more terrible than an army with banners.'"

It will be remembered that Mr. Daniels offered at the time of the bombing of the German warships to stand on the deck while "Admiral" Mitchell, as the Secretary nicknamed him, dropped bombs from his fleet of airplanes. Also, it will never be forgotten by those who were urging some separate bureau in the Navy Department to handle aeronautics, how definitely Secretary Daniels opposed such a change. Doubtless he was following the advice of his advisers, just as all heads of the Navy have. It is generally thought that the most effective smoke screen that the Navy lays is around the naval chief. Evidently it has been lifted in the case of Mr. Daniels and from now on we may possibly hear that he is convinced that airplanes can sink battleships.

Stability Calculations

IN this issue, Mr. Kerym Kroukovsky gives the detailed calculations for determining the degree of longitudinal stability of an airplane, following out the ideas developed in his previous articles. To anyone who has endeavored to make use of the formal theory of Bryan and Bairstow, this method will come as a godsend. It has been said that an efficient engineering department could design and test an airplane before its stability could be calculated. Given the data, it is possible for anyone with a fair knowledge of mathematics, to determine the stability of a new design with a high degree of accuracy. The use of this method of calculation should considerably improve the controllability and stability of our light planes, as they are usually made "at home" and are of entirely new designs. We would be interested to hear from any of our readers who use the method presented in this and succeeding issues.

The Aerial Mercury Air Mail Plane

Description of New Plane With Many Unique Features, Specially Designed for Mail Service

By NORMAN MEADOWCROFT, A.F.R.Ae.S

The first "Aerial Mercury" has just been completed and tested by the Aerial Service Corporation, at Hammondsport, N. Y. This company has been in business over five years.

This machine was designed by Harvey C. Mummert, who was for many years a designer for the Curtiss Company, and is a leading designer of light airplanes, having won trophies in this class at the Dayton Air Meet of last year. The ship was built under the supervision of Joseph F. Meade, who has had many year's experience on aircraft, with the Curtiss Company and others, both in this country and abroad.

A notable feature is that the plane was designed and built in three months, this being quite remarkable considering the facts that it is a plane in the 5500 lb. weight class, (fully loaded) and embodies many new and desirable features.

In designing this plane, the points borne in mind were strength, serviceability, ease of handling, low landing speed, ease of replacement of parts, high speed, and weight carrying.

The fuselage, wings and tail surfaces are built of very substantial proportions and the general impression is that it will stand a great amount of hard wear, and even abuse, without undue lessening of safety.

The plane is of biplane form, having no stagger, a horizontal top wing, and 1½ deg. dihedral on the lower wing, one pair of outer struts, and "Clark-Y" high speed, high lift, wing section. Ailerons are fitted to both upper and lower wings, for ease of control, and all ailerons and elevators are interchangeable. Elevators, rudder, ailerons and all controls are hinged on ball bearings of the self-aligning type, giving exceptional ease of control, and absolute freedom from damage due to corrosion. The aileron controls are arranged in such a manner that even if a lower aileron is carried away, or one cable breaks, control is still maintained over the other pair of ailerons. The wing beams are of built-up box section, the sides being formed of two-ply diagonal spruce planking, all glued and nailed together with galvanized nails. The ribs are of built-up truss type, and the completed wings have one coat of filler and two coats of varnish applied to render them moisture proof. On tests in the shop, during construction, one rib having an actual weight of 12 oz. held a distributed load of 1000 lb. before breaking, thus demonstrating the large factor of safety of its construction.

On each lower wing, a reinforced walk-way of 3-ply veneer is provided, extending the full length of the chord, allowing the mechanics to tread in safety and without damage to the plane, when loading or unloading the mail. Steps are also fitted to the fuselage in suitable positions for a man to stand in comfort while working on the engine. This avoids standing in precarious positions on engine support tubes, and greatly facilitates minor adjustments of the engine.

The fuselage is built up with 4 extra large section longerons, all in one piece, braced with built-up bulkheads, and covered with 3/16 in. veneer. It is 29 in. wide at the top, and 48 in. at the bottom, giving the pilot unrestricted view in all directions downward without moving his position.

Another feature is the providing of tunnels in each lower wing, which allows the pilot to see the landing wheels at all times, thus avoiding perhaps a bad crash in the event of a burst tire, which the pilot would otherwise be unaware of.

Power Plant

The engine is a standard 400 hp. Liberty, 12 cylinder, mounted in a steel tube frame, having adjustable ends, and ball joints at the junction to the longerons. The complete power plant is easily removable as a unit, for quick replacement. A metal covered bulkhead immediately behind the motor forms a fire-wall between it and the mail compartment.

The mail compartment has a capacity of 56 cu. ft., and is completely lined with sheet duralumin and fitted with hickory battens to take the wear of the mail sacks. A large, double hinged door provides quick and easy access to the compartment, and is fitted with approved lock and two heavy straps.

One half rear view of the Aerial Mercury control surfaces and exhaust heater. H. C. Mummert in the cockpit

The pilot's cockpit is roomy and comfortable, being lined with veneer, and having an adjustable seat. Compartments are provided for carrying log books, maps, and landing flares, and a cupboard behind the seat allows for the storage of luggage and tools. Instruments are fitted in suitable positions on the instrument board, all being marked in luminous paint. The control is by means of a standard stick, which in this machine is of duralumin tubing, and has a convenient switch in the end, for illuminating the board as may be required.

This avoids dazzling the pilot, as would permanent lights mounted on the board in the usual way. Three emergency controls are fitted to the board, one for releasing all gasoline from the main tank, one for releasing a plow blade in the tail skid, for use to avoid a crash on a restricted landing field and another to release Pyrene fluid from a tank at 100 lb. pressure, which is sprayed over the engine from pipes and carried all around the engine frame.

The control wheel operating the tail surface adjustment is also located conveniently to the pilot on the right side of the cockpit. All engine controls and wiring are carried along the fuselage in a metal tunnel, making a neat and fireproof arrangement. A branch taken from the exhaust pipe, carries hot air around a flexible pipe of large diameter, placed in the pilot's cockpit, and giving heat controlled by a valve placed within easy reach. This is a desirable feature for flying in zero weather.

An aluminum oil tank of 10 gal. capacity is connected with an air cooled duralumin oil-cooler. The radiator, 9 in. cartridge tubes, is fitted with controllable shutters and is suspended entirely on rubber below the engine. All filler caps are of the quickly removable, snap type. The main gasoline tank is slung under the fuselage under the mail compartment and is shaped to follow the lines of the fuselage. It is fitted with a 3-in. dump valve, but can also be arranged for quick release bodily, if required. The capacity is 92 gal., and in the upper wing is a 14 gal. gravity tank, securely mounted, and easy of access. The overflow from the gravity tank is carried to the trailing edge of the wing, where it is in full sight of the pilot.

For use when it is desired to carry a passenger, a portable seat of steel tubing frame, quickly secured by cables and turnbuckles, and having a comfortable canvas seat, is supplied. This fits into brackets mounted on the longerons in the mail compartment, and a removable windshield is also supplied in conjunction with it.

Shock-absorbing wing tip skids are fitted, of neat design, and another feature is the quickly removable engine cowling, always a difficult arrangement to work out satisfactorily. In this case, the object of easy detachment, with absolute safety and freedom from breaking away in flight, has been achieved. The landing gear is very robustly designed, depending for its shock-absorbing qualities on soft rubber discs in compression. The tail skid shocks are taken in the same manner, and the dangers of deterioration and breakage so apparent in the usual stranded rubber cord shock absorbers, are minimized.

The plane, as built and described above, has a high speed of 125 mi./hr., and a landing speed of only 47 mi./hr. If the plane is required for day-time service, an additional pair of smaller lower wings is supplied, so arranged as to use the same struts and fittings as the night plane, and capable of being changed in about half an hour. This plane then has a high speed of 135 mi./hr., and a landing speed of 54 mi./hr.

After two short preliminary trial flights at Hammondsport, the night plane was flown down from Hammondsport to Hazlehurst Field on Friday, March 6, making the journey of 290 mi. in exactly 2 hr., a very notable performance. On this trip the plane carried pilot H. C. Mummert, Joseph F. Meade, as passenger, with their personal baggage, and started with a full tank of fuel.

Top—Front view showing cellule arrangement. Bottom—View from above

Characteristics

		Night	
Weight			
Weight empty		3640 lb.	3462 lb.
Useful load		1875 "	1875 "
Mail	1000		
Pilot	180		
Gas	600		
Oil	75		
Equipment	25		
Weight full load		5515 "	5283 "
Areas and Dimensions			
Upper wing (including ailerons)		298.20 sq. ft.	286.25 sq. ft.
Lower wing (including ailerons)		253.52	147.50 "
Total wing area		558.72 "	485.75 "
Ailerons (total)		58.24	58.66
Horizontal stabilizer		40.8 "	40.9 "
Elevators		29.13	39.10 "
Total horizontal tail		69.92 "	69.92 "
Vertical fin		17.47 "	17.47 "
Rudder		14.55	14.82 "
Total vertical tail		32.02 "	32.02 "
Span—upper		42 ft. 11 in.	42 ft. 11 in.
Span—lower		47 ft. 1 in.	33 ft. 4 in.
Overall length		30 ft. 6 in.	29 ft. 6 in.
Overall height (tailskid on ground)		11 ft. 4 in.	11 ft. 4 in.
Chord, upper		7 ft. 0 in.	7 ft. 0 in.
Chord, lower		7 ft. 0 in.	5 ft. 0 in.
Gap		6 ft. 6 in.	6 ft. 6 in.
Stagger			6 in.
Performance			
High speed		132 mi./hr	125 mi./hr
Cruising speed		118 mi./hr	110 mi./hr
Stalling speed		61.5 mi./hr	55.8 mi./hr
Initial climb		1140 ft./min.	1110 ft./min.
Absolute ceiling		16438 ft.	14600 ft.
Range at cruising speed		500 mi.	560 mi.
Duration at cruising speed		4.74 hr	4.78 hr

Paper Read on Aluminum Alloys

Paper on "A Method of Improving the Properties of Aluminum Alloy Castings," by S. L. Archbutt, was presented at the Annual General Meeting of the Institute of Metals held in London, on Wednesday, March 11, 1925. The experiments described in this Paper and the results obtained from them are to be regarded as indicating the possibilities of a method of treating aluminum and certain of its alloys, which serves to eliminate at all events a considerable proportion of dissolved gas and thus reduces unsoundness, and to a considerable extent removes pin-holing. The process suggested consists in allowing the molten alloy or metal to cool slowly in the crucible in the furnace until it has just completely solidified; it is then remelted, and may be carefully stirred, raised to the pouring temperature, and cast. Ingotting the metal is not satisfactory, as the ingots cool too quickly, and during remelting are too much exposed to the furnace gases.

In a later experiment described, passage of an inert gas through the melt during slow cooling and solidification has been found to improve still further the soundness of resulting sand cast-bars.

Slightly anomalous results have been obtained in some cases, and it is not yet clear how far the method is of value in other alloys, whether consisting mainly of aluminum or of other metals. It is evident that much further investigation is required. Meanwhile, the author has learnt that simultaneously and independently Prof. C. A. Edwards and W. E. Prytherch of Swansea, working on the effects of gases in copper (for the British Non-Ferrous Metals Research Association) have discovered a similar effect obtained by solidification in the crucible in the case of pure copper.

Stout Company Moves

On March 2 the Stout Metal Airplane Co. changed their address from the General Motors Building in Detroit to the Ford Airport, Dearborn, Mich. This move brings the office and factory together.

The N. A. A. National Air Policy

The following statement issued by Godfrey L. Cabot, President of the National Aeronautic Association is of extreme importance as it commits the membership of the Association to a very definite policy. It is the first announcement of policy that has been issued this year and therefore represents the views of the present executives who have undoubtedly sounded out the membership before making such an important statement.

Summarizing, the policy of the N A A can be stated briefly as follows:

It urges the passage of the Winslow Bill.

It is opposed to a unification of our air services as proposed by the Curry Bill.

It believes that the expenditure of $433,000,000 by the government during the last five years has made America "very distinctly and emphatically first in the air" and that those who claim "inadequate results" are "unjust."

It blames smaller appropriations for our not having "quite as large an air force as England."

It believes that cooperation between the Army and Navy Air Services is "reducing to a minimum the duplication of effort."

It urges more bombing tests.

It asserts that "careful quantitative experiments" were made on the George Washington and the Navy accomplished more than was made public.

It urges a separate list for promotion of air officers.

It urges the "high command" to get into the air and that there be no repetition of "very competent fliers being placed under the command of grossly ignorant majors."

It urges the study of aerodynamics by the high command so that they can pass on technical questions.

It looks forward to the time when commander-in-chief of both armies and navies will direct those forces from the air using airplanes in clear weather and airships when weather is inclement.

It urges immediate construction of aircraft for this purpose.

It urges air committees in Congress.

The complete statement follows:

We think that an authoritative statement as to the attitude of the National Aeronautic Association with regard to aeronautical matters recently investigated and discussed by Congress would be opportune at this time.

In the first place the National Aeronautic Association has for three years been seeking enactment of Federal legislation placing the control of commercial aeronautics under a Bureau of Civil Aeronautics in the Department of Commerce. Each succeeding Board of Governors has given its attention to the various bills introduced and pushed by Samuel Winslow, who has cooperated very actively with him in the preparation of the bills. It is a matter of great regret that no such bill reached [illegible] the present Congress. This bill in its various forms did not seek to control the governmental aeronautical activities; it did [illegible] possible [illegible] the inspection and licensing of all privately [illegible] machines and the examination of pilots employed in operating the [illegible] with a view to licensing those who showed themselves physically [illegible] competent.

We hope that some such bill will be passed at the next session. We [illegible] that the result would be a continuous and progressive diminution [illegible] civilian flying and a consequent progressive increase in the [illegible] of the public with a resulting growth of civil and commercial [illegible].

Secondly, this bill is incompatible with the Curry Bill which would [illegible] of the Army, Navy and Post Office aeronautics, as these three Departments would no longer be mistress in their own houses [illegible] have to get their aeronautical supplies and management from [illegible] department which would be interpolated between them and the [illegible] of the United States.

We believe that such a bill would increase the evils that it seeks to [illegible] and in particular would introduce greater delay, greater confusion, greater expense and less efficiency, which we think has been the [illegible] England where this plan has resulted in the loss of all the international records and in the use in warfare of machines of types going back to 1917 which is not believed by critics of the Air Ministry to be [illegible]. We think that under present conditions the Curry Bill [illegible] the effect of placing civilian aeronautics under military control, which we think needless and undesirable in time of peace.

We wish, thirdly, to most earnestly impress upon the American people [illegible] suggestion of wholly inadequate results from the expenditure of $433,000,000 in governmental aeronautics within five years is very unjust. America in part by reason of this expenditure is very distinctly and emphatically first in the air in the excellence of the types of machines developed, in the excellence of the types of aircraft engines developed, and in the excellence of the pilots developed. It was not a matter of accident that the numerous efforts to fly around the world made by France, England, Italy, Argentina, Portugal were less successful than that made by the United States Army and Navy. In fact no other nation succeeded in getting half way around the world, although there were various replacements of machines and engines in their efforts to do so.

It is well known that two of our planes with their crews came through and completed the circuit of the globe in 351 flying hours. It is not accident that we hold fifty-five international records, much more than half of all the international records recognized by the F.A.I. It is regrettable to be sure that due to smaller appropriations, we have not quite so large an air force as England, and we have no doubt that the Congress will supply this deficiency just as soon as it is convinced that the money will be wisely applied. We do not claim, nor would the respective services claim, that no errors have been made and no duplication of effort exist under present methods. Nor would Congress be so unreasonable as to expect perfect service anywhere. But Congress will reasonably require that our results, measured by our appropriations, should compare favorably with those obtained in other nations. We think that on the whole they will stand this test, and hope and believe that this will continue to be the case.

To this end it is our agreeable duty to co-operate with the Army, the Navy and all branches of the Government that are in touch with aeronautics.

We call attention to the fact that there is a Joint Army and Navy Board and a Joint Army and Navy Air Board who are working together in order to a minimum the duplication of effort and to secure to the maximum the advantage of lower requisitions and the co-ordination and availability for both of the experience gained by each.

Sometimes the Army will give a contract for a certain number of machines of a given type and turn over a portion of them to the Navy to be reimbursed pro rata, and sometimes the Navy will reciprocate in kind. They are both very efficiently helped by the National Advisory Committee for Aeronautics which keeps in touch with the best aircraft engineering [illegible] all over the world and gives them competent advice on aerodynamic problems.

Let us briefly mention certain evils apparent under the present status and possible remedies for the same. There is discontent among certain of the Navy fliers because they have not been given as much opportunity as they would like to have had to show their proficiency in bombing. We think this is regrettable and hope that more opportunity will be given them hereafter with a view first of giving them a chance to show their mettle and also by superior merit in a competitive art, second, to throw further light on the problem of marksmanship under different conditions and in particular on the question of the destructive effect of bombs as modified by the conditions only obtainable through impact.

It is no longer a secret that careful quantitative experiments were made on the George Washington by placing bombs at exactly determined positions on different parts of the vessel and in the water alongside. Those who have closely followed this controversy are now aware that the Navy has accomplished a good deal more in this regard than was made public at the time. Military men instinctively shrink from publicity with regard to technical military experiments and therefore receive and become inured to unjust adverse criticism based upon an imperfect knowledge of the facts. It should however be borne in mind that the effect of a bomb placed on the deck of a battleship is quite different from the effect of the same bomb if dropped from a height, particularly if it has a hardened nose point which enables it to pierce one or two of the decks before exploding.

A matter that has caused some discontent in both Army and Navy air services is that whereas the death rate is higher among air men than in other branches of the service the rate of promotion is not higher.

The head of the Army Air Service has a plan to mitigate this and other evils in the way of promotion preferment by erecting the Army Air Service into a separate corps, and we believe that a bill is under preparation in the interest of the Navy along the same lines. We think such measures should receive the sympathetic attention of Congress and [illegible] careful consideration. We hope that if such a plan be adopted it will not be forgotten that the ablest, the most ambitious, the most competent young fliers will look forward to the time when as commanders-in-chief they will fight battles from the air, not with the guns that their airplanes carry, but with the radios that the commanders-in-chief will use in directing the ground forces or sea forces beneath. We hope it will be possible so to arrange that the sea man who desires to remain in the sea service can do so and that the air man who wishes to join some separate service may at the discretion of his superior officers be given his opportunity.

Many of the younger men need better to appreciate the fact that as officers of the line whether Army or Navy they must not be content simply to be competent fliers and versed in the science of aeronautics but must also understand other branches of military service in which they may at any time be called and for which they must at all times be prepared. On the other hand it is the duty of the high command and of all the officers of both services to get into the air and know what it is like to look out over the country from the air and to have some thoroughly sound knowledge of the fundamentals of aeronautics.

This is much better appreciated now than it was during the time of the World War when very competent fliers were placed under the command of grossly ignorant majors, but there is still too little personal touch between many officers of the high command and actual personal experience in the air. This of course does not mean that elderly men should learn to be pilots. It simply means that they should get up in the air once in a while and look around under the pilotage of a junior subordinate and that they should become thoroughly grounded in the fundamental propositions of aerodynamics by careful and considerable study of the text books.

Detailed knowledge of machines and supplies they can properly leave to their subordinates, but they cannot properly fail to know, for instance, what the angle of incidence means so that they can put aside as absurd the attempts to adjust the angle of incidence with a camber between the air foils and the fuselage, and shall in general be able to discriminate between new suggestions which are worthy of study and new suggestions which are really old suggestions utterly exploded by actual experiment.

It is too obvious to require argument that the time is coming when commander-in-chief will fly in battle and from their headquarters in the air direct the ground and sea forces under their command. The question of whether for this purpose the commanding general or admiral will select for his flag ship a leviathan of the depths of the air or a smaller swifter and less vulnerable machine will be determined by the circumstances of each particular occasion. Probably the heavier-than-air machine will be preferred in clear weather; the lighter-than-air machine may prove more suitable sometimes in cloudy weather when long continued flight and the best possible systems of wireless communication are the chief factors.

The point we wish to urge now and here is that specifications and plans should be prepared for aircraft specifically intended for the commander-in-chief of the Army or the Navy to use in viewing and judging military maneuvers in time of peace. First, because in this way a juster judgment of the real facts and situations that may arise during those maneuvers can be obtained than in any other way, and second because they are thereby preparing themselves for the possibility of using the same methods in actual warfare to direct opposing forces, and thus obtain the same supremacy in air wisdom for our high command that our gallant fliers have demonstrated in the tactics of actual flying.

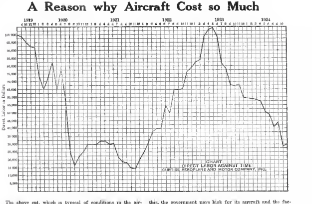
Lastly let us consider the duties of Congress and whether or not it is possible for them better to fulfill their obligations toward the aeronautical branches of national defense and development. Nothing could be more unjust than the innuendos that have implied indifference on the part of our legislators to the air branches or an unwillingness to do what can reasonably be asked of them. They will certainly appreciate that the National Aeronautic Association, in the recommendations which it made through the mouth of its chairman of the program committee, Howard E. Coffin, was speaking with a wholly friendly and appreciative voice and is no wise in a spirit of unfair or unreasonable criticism. We respectfully reiterate these suggestions which, based primarily on the sagacity and long experience in such matters of our Governor Coffin, have been fully and deliberately adopted and sanctioned by the Board of Governors after careful discussion.

We wish, in brief a continuity of effort, standing committees in both houses of Congress and continuing appropriations so far as these can be wisely predetermined by the different executive branches and are permitted by the Constitution and Statutes of the United States. A case in point is the needless time that has been taken to examine the claims of a private individual who has vainly sought to patent various ideas previously fully developed by others and failing in this has brought wholesale accusations against nearly everybody that was doing anything of importance in the aircraft industry. Time would have been saved had there been a standing committee, versed in the fundamental facts as to the development of aircraft to which such matters could have been referred. We do not for a moment regret this investigation and for the reason that the gentlemen therewith charged took a broad view of the question and studied the whole matter from a constructive viewpoint. We only regret that they were hampered in that study by too much consideration of less important matters. We congratulate the country on the dignity, the courtesy, the openmindedness with which these matters have been handled by all three committees therewith charged, the Military Affairs Committee, the Investigating Committee, and the Interstate Commerce Committee.

We end as we began with the devout hope that the incoming Congress will find time to reach a vote on some Federal measure along the general lines of the Winslow Bill, confident in the belief that in this event the Congress will give us the needful governmental guarantee of safety in flight and establish rules of the road without which the aircraft industry cannot be developed along the safest lines.

Godfrey L. Cabot
President

A Reason why Aircraft Cost so Much



The above cut, which is typical of conditions in the aircraft industry, shows that the charges for direct labor (excluding overhead) drop from $100,000 to $16,000 per month in a little over a year. Later they rise again with equal rapidity and then fall off as suddenly. These violent and rapid fluctuations represent men hired and trained and then discharged as soon as they have learned their jobs. The overhead tends to remain the same, as it is impossible to build up and discharge an organization of engineers and company officers four times within five years. As a result of this, the government pays high for its aircraft and the factories lead a precarious existence. One of the suggested remedies is the subletting of contracts by firms who have work to those that are short of work. The fluctuations shown in this chart are not unique in the aircraft industry but are typical of the conditions that have prevailed throughout the last few years. It must be obvious to anyone that such variations of work cannot make for stability. This chart shows more clearly than any other exhibit one of the principal reasons why the Government pays so much for aircraft.

Curtiss Financial Statement

The following is the report of the president of the Curtiss Aeroplane and Motor Co. to the stockholders and dated March 2. It shows an improvement over previous years that is noteworthy and contains a statement of new designs and products under way.

To the Stockholders:

The financial results of the operations of your company for the year 1924 are submitted herewith. These results show steady progress in the liquidation of capital employed in the business, along the lines laid down in the annual report for the year 1923.

During the year your company has reduced its funded and other indebtedness $966,731 04, while the reduction of cash assets other than inventories, during the same period, has been only $136,675 67. The working capital position of the company is stronger than it has been at any time, there being practically no current liabilities. The Curtiss Field at Mineola and the experimental plant at Garden City have been cleared of mortgage debt.

The net earnings after full depreciation amounted to $156,228 16, a large part of which was derived from commercial operations as distinguished from Government contracts. The Directors have declared, for the period, dividends of $6 00 on the preferred stock of the company.

The sharp competition from Government plants, and the destructive competitive bidding on Government contracts, noted clearly in last year's report, continued throughout the early part of 1924, especially from the Navy. Toward the close of the year there was a distinct betterment in both respects, especially in respect to Army contracts, due to the fact that the leaders of the Army Air Service made an intelligent study of the matter and began, of their own volition, to shift their policy with regard to the placing of contracts. Throughout most of the year a special committee of Congress, appointed to make a broad study of aviation as a whole, was in session. The work of this committee seems to be distinctly constructive and its preliminary comments seem to indicate that Congress will take a stand against the destructive tendencies that have grown up in the Air Services since the close of the War.

As indicated in last year's report, your company has not risked its capital in large experimental advances as it had in previous years but it has, nevertheless, during the year, produced some notable advances in the art. The development of the Reed metal propeller has been pushed forward steadily and is now a substantial source of revenue to your company. Two standard commercial types of airplanes have come out of the engineering division, one of them a mail ship for the Post Office Department and the other a purely commercial airplane. Both show fair promise of success. In the military types the Curtiss CS was adopted during the year by the Navy as a standard light bomber, scout and torpedo plane, but no production contracts resulted to your company owing to the fact that your company was unwilling to build these airplanes below what it considered a fair price. A new two-place observation ship for the Army is considered one of the best engineering models that your company has produced during its history and promises to be a good source of business, both at home and abroad for some time to come.

In the development of motors, excellent work has been done by the engineering division of your company. For the first time, your company entered the field of the air cooled motor and produced, for the Army, a type of high promise. The motor is still entirely in the development stage but enough has been done to indicate that it has large possibilities. The successor of the famous D-12 Curtiss motor was developed during 1924 and passed the fifty hour test in February, 1925. This motor, while some fifteen pounds lighter than the D-12, delivers approximately 25 per cent more power and is considered by competent engineers to be almost as great an advance as was the D-12 itself, which brought back to the United States the speed records of the World and held them for nearly three years.

It is not possible at this time to outline very definitely the policies of your company for the coming year. Aviation is in a curiously uncertain state. After five years, during which period the industry as a whole has dwindled as a result of policies or lack of policies of the Government Departments, public opinion appears at this time to have taken a definite constructive turn. The policies of your company will be determined when that public opinion has crystalized into definite Government policies. In the meantime, the commercial branches of your company's business are being pushed forward; the policy of building up liquid capital resources has gone forward, the engineering nucleus of your company is being maintained, markets are assiduously sought in Europe, South America and the Orient, both commercial and military, overhead costs are carefully controlled. Your company is ready to move forward or to maintain a cautious attitude, as conditions may warrant.

A proposal will be laid before the stockholders at the Annual Meeting, the notice of which is enclosed herewith, to increase the Board of Directors from nine to eleven. This change is proposed for the purpose of allowing representation to new interests who have become substantial stockholders in the company and who have been helpful to the company throughout the past year.

CURTISS AEROPLANE & MOTOR COMPANY, Inc.,
C. M. Keys, President

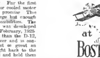
CONDENSED CONSOLIDATED BALANCE SHEET, DEC 31

	1924	1923
ASSETS		
Property Accounts (Net)	$1,880,888 28	$1,875,801 98
Patents and Good Will (Net)	1,118,481 68	1,266,887 45
Investments	52,001 00	53,501 00
Inventories	818,626 47	1,187,1[illegible] 66
Accounts and Notes Receivable	402,436 40	474,4[illegible] 88
Cash	172,242 87	346,692 08
Investment in Loans	285,000 00	600,000 00
Investment in Bonds	60,000 00	
Deferred Charges	42,804 86	78,6[illegible] 98
TOTAL	$4,800,818 77	$5,564,248 77
LIABILITIES		
Mortgages Payable	$352,006 00	$1,820,000 00
Accounts Payable and Accrued Interest, etc.	56,746 40	345,479 44
Reserve for Federal Taxes		1,703 12
Capital Stock		
Preferred	2,528,100 00	2,523,150 00
Common	638,667 60	656,2[illegible] 58
Surplus	260,400 84	625,[illegible] 68
TOTAL	$4,606,616 77	$5,564,248 77

CONSOLIDATED INCOME AND SURPLUS ACCOUNT FOR THE YEAR ENDING DEC 31, 1924

Sales		$2,985,850 58
Deduct—Cost of Sales		2,634,007 70
Gross Profit on Sales		$351,842 28
Add—Other Income		108,01[illegible] 18
Add—Profits of Subsidiary Companies		14,51[illegible] 41
Gross Profit		$474,3[illegible] 87
Deduct—Selling Administrative and General Expenses		78,8[illegible] 87
Net Profit before Deducting Interest, Depreciation of Patents and Special Charges		$395,494 [illegible]
Deduct—Interest	$80,[illegible] 07	
Deduct—Depreciation of Patents	86,883 24	
Deduct—Storage Expenses Assets Corporation	60,212 58	233,2[illegible] 84
Net Profit		$156,228 16
Add—Surplus Dec 31, 1923		225,5[illegible] 68
		$381,7[illegible] 84
Deduct—Dividends paid on Preferred Stock		151,3[illegible] 00
SURPLUS		$230,400 84

What One Newspaper Is Doing for Aviation



This cut appears at the head of a weekly column of news in the *Boston Evening Transcript*. This effort deserves to be emulated.

Stability and Controllability of Airplanes

Appendix I—Method of Calculation

By B. V. KORVIN-KROUKOVSKY

From the earliest days of aeronautics and up to the present time stability remained the most troublesome question for an early experimenter or present aeronautical engineer. Despite the large amount of literature on the subject and great advances of science there is still no simple method available by which the designer can estimate the stability of the airplane to be built, while the latter is still on the drawing board. In most favorable circumstances the scale model of the airplane can be constructed more or less by guess and tested in a wind tunnel, in many cases even this is not found possible and guesswork is incorporated directly in the full sized airplane. It is no wonder then that so many airplanes are found deficient from the stability point of view. Indeed while we have sufficient knowledge to predict the performance of the airplane with fair degree of accuracy, the prediction of stability characteristics is very doubtful, except when the new machine represents but slight modification of some existing one. Some airplanes are found to be satisfactory with the center of gravity as far back as 35 per cent of the chord, while others give trouble at 30 per cent. It is realized that as the center of gravity is located higher with respect to the wing it must also be moved forward, but the exact relation is not known. The effectiveness of the tail is talked about lately and although the importance of the aspect ratio of the empennage is often mentioned, no systematic discussion of its effect is available. Even the wind tunnel tests fail to show the effect of the location of the center of gravity with respect to the propeller thrust line. Thus we see that although the importance of different characteristics on the airplane is realized and occasionally discussed qualitatively, the information as to their quantitative and aggregate effect is still lacking. In the present work we will attempt to fill the want of such information and to devise the method by which the degree of stability of an airplane can be predicted from its design characteristics, and will demonstrate the practical use of the method by applying it to existing airplanes. Of course we will have to limit ourselves to the consideration of only the most important characteristics of the airplane and to resort to empirical data in the few places where aerodynamical theory fails to supply the necessary information. Yet we will be able to show that calculated results agree with the properties of the machines as reported on basis of the flying tests.

Airfoil Instability

The airfoils of the type used for the supporting surfaces are known to be unstable, i.e. if balanced about some point near the chord while being subjected to a stream of moving air and left free to rotate they will turn over. To be able to balance the airfoil at some useful angle of attack we must locate the point of rotation at the center of pressure corresponding to that angle. This means that the point of rotation must be placed from 35 per cent to 50 per cent of the chord from the leading edge, and this is where the center of gravity was usually placed on the old time airplanes. We must realize, however, that the *center of pressure* is only artificial notation, namely the point of intersection of the resultant of the air forces with the chord of the airfoil, and has no direct connection with the stability. Indeed it is very unfortunate that such a notation exists, as probably more unstable airplanes were produced by the attempt of the designers to locate the center of gravity at some position of the center of pressure than by any other cause. We will see later that the position of the center of pressure does not appear at all in the formulas for stability, and that the *Center of Gravity should not be placed at the Center of pressure.*

On another hand it is customary to report in the wind tunnel tests on airfoils the moment of the air forces about the leading edge, and this less artificial and more scientific quantity is much more suitable for the investigation of airplane stability. Both wind tunnel experiments and the airfoil theory show that for the moderate angles of attack the moment, lift and center of pressure coefficients are connected together by the simple relation

$$\frac{p}{l} = \frac{C_m}{C_l}$$

where C_m is the moment coefficient defined as the moment about leading edge divided by the quantity qSl
C_l is the lift coefficient defined as lift divided by qS
q is the dynamic pressure $= \frac{1}{2} \rho V^2$
ρ is the density of air expressed in mass units
S is the wing area in square feet
V is the velocity of flight in feet per second
p is the distance of center of pressure from leading edge
l is the length of the chord, p and l are in feet.

For all airfoils used for the wings of airplanes, the moment about the leading edge is diving moment and should be denoted by minus sign. The minus sign is sometimes omitted in the reports on the airfoil tests as the condition is general and well known. When the moment coefficients C_m determined in the wind tunnel tests for several airfoils are plotted against C_l—the lift coefficient,—the diagram represents several parallel and practically straight lines. This shows that for most of the airfoils the slope of the C_m vs. C_l curve is the same and that the relation

$$\frac{dC_m}{dC_l} = m$$

will hold. The constant quantity m, found to have the value of 0.25, can be called the *natural stability of the airfoils.**

It was mentioned before that ordinarily the airfoil is unstable in the useful range of angles of attack if the rotation is considered about some point at 35 per cent to 50 per cent of the chord. It is stable, however, if we consider the rotation about the leading edge. Unfortunately the balance in this case is possible only for an angle of attack corresponding to a slight negative value of the lift coefficient. In other words if the airfoil were pivoted at the leading edge and placed in the air stream, it will steady itself at some negative angle of attack giving small down pressure. The degree of initial stability for any other location of the center of gravity x on the chord l can be readily determined by transferring the moments from the leading edge to that point as follows:

$$\text{Moment Coefficient} = \frac{x}{l} C_l - C_m$$

$$\text{Stability Coefficient} = d\,(\text{Mom. Coeff.})/dC_l = \frac{x}{l} - m$$

The condition of stability requires that this coefficient be negative. Thus we see that the degree of stability of the single wing decreases as the center of gravity is moved back along the chord, and the stability vanishes (neutral stability) when $x/l = 0.25$. Were we able to find the airfoil which could be balanced with the pivot located at 25 per cent of the chord from the leading edge we would find that such an airfoil would remain in neutral equilibrium for all moderate angles of attack. This means that the center of pressure of such an airfoil will remain stationary and the ratio C_m/C_l will be constant, which means in turn that C_m will vanish simultaneously with C_l. This phenomenon actually occurs in case of the symmetrical double cambered airfoils often used

*The importance of m in discussion of the stability was, we believe, first explained by L. Breguet and R. Devillers (*La Technique Moderne*, 1-er, October 1920) who gave it the value of 0.20. Margoulis (*L'Aéronautique*, Juillet 1923) used the value of $m = 0.25$, the value which we found to check very closely for the aerofoils popular among American Designers.

for the tail surfaces, which have neither lift nor moment about leading edge at zero angle of attack, and have practically stationary center of pressure at 25 per cent of the chord.

We see from the above that for stability of a tailless airplane its center of gravity would have to be placed not farther back than 25 per cent of the chord. As the center of pressure on cambered airfoils giving good lifting quality moves from 30 per cent to 50 per cent of the chord such an airplane will be evidently badly out of balance. In order to balance it we will have to add tail surfaces, subjected to down pressure of the air. Now, the empennage besides balancing also gives a little stability, which would allow us to move the center of gravity safely a little farther back, usually to 30 per cent of the chord. This is affected, however, by the stabilizing efficiency of the tail, and by the vertical distance of the center of gravity from the wing and thrust line, which we are prepared now to investigate.

The sketch given here shows the forces and moments acting on an airplane in flight. The force of gravity acts of course through the center of gravity and is not shown, as producing no moment it is of no interest to us. This applies to the components of gravity perpendicular to the line of flight as well as parallel to it, the latter occurring during climb and glide. We may mention here, that as usual in the mechanics of rigid bodies we will consider all moments and all rotations taking place around the center of gravity. The effect of the head resistance on stability will be neglected entirely, or in other words it will be assumed that it acts near to the center of gravity and varies nearly as dynamic pressure q. The thrust line is assumed to be parallel to the line of flight and the effect of its inclination at different angles of attack will be neglected. We mentioned before that in order to obtain a simple and practical working method we must limit ourselves to the consideration of only the most important causes and effects. In accordance with this statement we will consider only the moments generated by the change of the angle of attack and will neglect the moments due to vertical and horizontal translational velocities resulting from pitching. The effect of these velocities can be shown to be small by the application of the more exact and much more complicated methods of Bryan and Bairstow. We will, however, make exception in the analysis of the effect of propeller thrust, where the change in velocity is the most important factor.

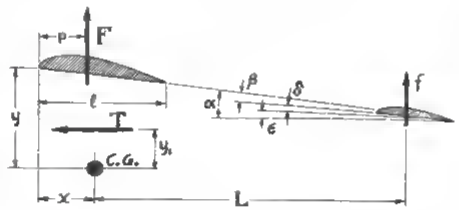
Detailed Calculation

The wing shown on the sketch represents the wing of a monoplane of constant chord, or mean chord of a monoplane with the tapered wings or of a biplane. In other words it is the wing of an imaginary monoplane equivalent in all its properties to the actual wing combination of the airplane under consideration. For the convenience of reference we will summarize now the notation used in this work and not explained earlier.

C_1 — Lift coefficient of the wings.
C'_1 — Lift coefficient of the empennage.
W — Weight of the airplane in pounds.
P — Rated horsepower of the engine.
S — Wing area in square feet.
s — Empennage (stabilizer and elevator) area in square feet.
b — Overall span in feet.
b' — Empennage span in feet.
G — Mean gap in feet.
α — Angle of attack of wings in degrees.
β — Angle between the chords of wings and empennage.
δ — Angle of attack of the empennage.
ϵ — Angle of downwash.
R — Effective aspect ratio of wings $= k b^2/S$.
R' — Effective aspect ratio of the empennage $= b'^2/s$.
F — Lift of the wings $= q S C_1$.
f — Lift of the empennage $= q s C'_1$.
M — Sum of the moments of all forces about C.G.
M_c — Moment coefficient $= M/qSl$.
n, n', m, w', k, N, B, X — the coefficients significance of which will be explained later.

We will retain the conventional notation by assigning minus sign to all diving moments and plus sign to all stalling ones, and we shall assign positive sign to all quantities measured as shown on the sketch, i.e. the center of gravity located below the wing and the thrust line, and the angle of stabilizer setting measured down from the wing chord. This settled we can write now the moment equation for the diagrammatic airplane as follows:

$$M_r = (x - p)\,F - fL - Ty'$$



Let us assume now that the airplane is pitched through the small angle $\Delta\alpha$, corresponding to a small increment of the lift coefficient ΔC_1. Several of the quantities in the above equation will undergo small changes, and neglecting the small quantities of the second order we can write a new moment equation for the diagrammatic airplane as follows:

$$M_r = (x - p)\,F + \Delta(x - p)\,F + (x - p)\,\Delta F - fL - \Delta fL - Ty' - \Delta Ty'$$

In writing this equation we assumed that the center of pressure on the empennage does not move, the assumption already justified for the symmetrical sections. Subtracting the first equation from the second we get:

[1] $$\Delta M = (x - p)\,\Delta F + \Delta Ty'\,\Delta(x - p)\,F - \Delta fL -$$

We will call the moment coefficient of the airplane the quantity $M_c = M/qSl$, and will endeavor to examine and expand each of the increments in the above equation in such a way as to be able to write down the derivative of M_c with respect to the lift coefficient C_1, which we will call the *Stability Coefficient* and will denote by $-N$. In doing this we will treat the quantity q as constant.

The lift of the wings can be written

$$F = q S C_1$$

[2] hence $$\Delta F = q S \Delta C_1$$

In order to expand Δx we must call attention to the fact that x and y are the ordinates of the leading edge of the wing with respect to the center of gravity, and that x is always measured along the line of flight and y perpendicular to it. Hence the increment of x will depend on the value of y and the increment of the angle of attack $\Delta\alpha$. It is easy to see that

$$\Delta x = \frac{\pi}{180}\, y\, \Delta\alpha$$

where $\Delta\alpha$ is measured in degrees. It is known from the laboratory tests on airfoils that for the moderate angles of attack used in ordinary flight the lift coefficient of each airfoil is the linear function of the angle of attack, i.e. $dC_1/d\alpha$ = Consant. The value of this constant varies but little for different airfoils and depends almost solely on the aspect ratio, as this will be discussed in detail later in connection with the study of the tail effect. At present it will be sufficiently accurate to adopt the mean value of $dC_1/d\alpha = 0.07$, corresponding to an effective aspect ratio of 5. Substituting this in the above formula for Δx we get:

$$\Delta x = \frac{\pi}{180}\, y\, \Delta C_1 \frac{d\alpha}{dC_1} = \frac{\pi}{180}\,\frac{1}{0.07}\,\Delta C_1$$

[3] or finally $$\Delta x = 0.25\, y\, \Delta C_1$$

(To be continued)

Curtiss Wins C. O. Award

There has been a general misunderstanding concerning the results of the Corps Observation airplane competition that was held at McCook Field during the last few months.

Early last spring the Air Service invited competition in the development of a new Corps Observation type airplane to be powered with the Packard 1500, Wright T-3, or other acceptable motors of that type. This competition was scheduled to be held in November and a Board of Officers was appointed to render a report thereon. This competition took place and the Curtiss type "Falcon" won it over the Douglas XO2.

At about the same time, as the Air Service required a plane which would replace the DH powered with Liberty motors, the Curtiss and Douglas Companies were invited to submit their machines for consideration along with the McCook Field type and one previously presented by another company. The airplanes desired by the Air Service were for immediate service use, requiring prompt quantity production. Maximum performance or military adaptability were not considered of primary importance. The Board recommended and the Chief of Air Service approved the immediate purchase of seventy-five Douglas ships with Liberty motors. At the same time the Chief of Air Service purchased a quantity of ten of the more advanced type of Curtiss Corps Observation planes. The speed of the latter with the Liberty motor was over 150 m./hr., as against about 137 m./hr. for the Douglas.

Reverting to the official design competition for a new type of observation plane, we quote from the official statement of the Air Service, as follows:

"The War Department has awarded $70,000 to the Curtiss Co., and $60,000 to the Douglas Co., for the experimental observation airplane manufactured by each of these companies, and the development work involved in the production of these planes.

"The Army Air Service is seeking a safer and more maneuverable type of airplane for general observation use that will replace the war-built DH's.

"The awards were made as a result of tests conducted at McCook Field, Dayton, Ohio, Jan. 23, by a board of officers convened for that purpose. Members of the board were, Capt. Gerald E. Brower, Capt. Lloyd L. Harvey; Capt. Walter Bender, 1st Lt. Carl A. Cover, and 1st Lt. Harold R. Barris. They are all expert aviators or observers and made actual tests of the new designs of observation airplanes which have been submitted by the Curtiss, Douglas, and Wright Companies.

"The speed of the tested types was over 130 mi./hr., with ceiling over 20,000 ft.

"A system of grading was arranged, which included performance, flying qualities, maintenance and miscellaneous features. A total of 30 points was granted for performance based on speed, service ceiling, and cruising radius, 35 points were granted for flying qualities, which included stability, maneuverability, and controllability, landing and taxiing and take-off, 20 points were granted for maintenance, which included both the engine and airplane; 10 points were given for ease of manufacture, 50 points were granted for miscellaneous features, which included cockpit arrangement, safety of crew, cooling system, self-starter, fuel-capacity, control mechanism and stabilizer adjustment.

"The Curtiss model exceeded the basis of rating by three points, scoring a total of 148 points, and the Douglas came up to the requirements with a score of 145.

"The board was favorably impressed with the strides that have been made in commercial airplane manufacturing and design within the past few years."

Government Competition with Commercial Companies

In the past, whenever there was a news feature that required the use of airplanes to expedite the delivery of pictures or to photograph events Army, Navy and Air Mail planes have been available to the news and picture services for this purpose. This competition has caused the loss of many orders to the companies who would have otherwise been paid for this work.

Recently, as the result of protests by commercial aircraft companies, the use of government airplanes for this purpose has been discontinued.

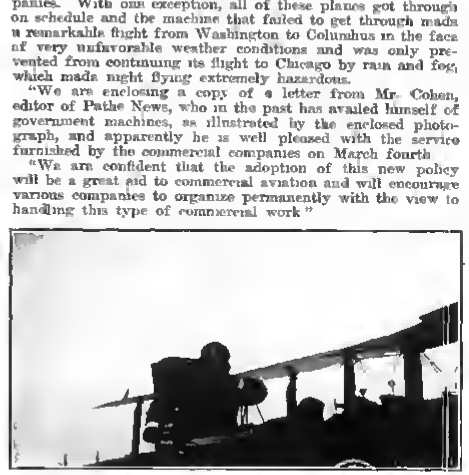
A letter from Casey Jones, manager of the Curtiss Exhibition Company, confirms this new policy. He sends a picture of Harry Hardy, camera man for Pathé News, taken before a recent flight made on the day of the total eclipse. "This picture illustrates how," Mr. Jones writes, "in the past, the Army has competed with commercial companies in supplying airplanes and airplane service for strictly commercial purposes.

"This practice has done a great deal to develop a demand for commercial airplanes and now that the commercial companies are in a position to supply a competent and quick service, all branches of the government, including the Air Mail, Army, Navy and Marines, through a recent statement of policy, with particular reference to the transportation of pictures and films of the Inauguration, have definitely stated that they will no longer compete with commercial companies in events of this nature.

"It is interesting to note the immediate results of the adoption of this policy. On March fourth ten commercial planes left Washington for various cities including Philadelphia, New York, Boston, Columbus and Chicago, carrying films and pictures for at least ten different newspapers and film companies. With one exception, all of these planes got through on schedule and the machine that failed to get through made a remarkable flight from Washington to Columbus in the face of very unfavorable weather conditions and was only prevented from continuing its flight to Chicago by rain and fog, which made night flying extremely hazardous.

"We are enclosing a copy of a letter from Mr. Cohen, editor of Pathe News, who in the past has availed himself of government machines, as illustrated by the enclosed photograph, and apparently he is well pleased with the service furnished by the commercial companies on March fourth.

"We are confident that the adoption of this new policy will be a great aid to commercial aviation and will encourage various companies to organize permanently with the view to handling this type of commercial work."



No more movies taken from gun rings of government airplanes

My dear Mr. Jones:

Congratulations on the splendid work of your Company as well as of your own good self in transporting our Inauguration films. Not only can I say this from the general knowledge of results achieved, but also from personal experience in the front cockpit of that little racer of yours.

Transporting those films from Washington to New York in the record-breaking time of one hour and twenty-eight minutes is a record worth being proud of. It is a great step toward making more feasible the development of commercial aviation and I am quite confident that such achievements as these will encourage the wider use of airplanes for quick transportation.

I noted especially and with much pleasure the careful preparations that you made to insure speed and safety, on all of the planes that we used. It is this thorough service that bespeaks efficient organization and assures success.

Very truly yours,
(Signed) E. COHEN

New Air Balance and Small Wind Tunnel

By ALBERT MERRILL
California Institute of Technology

Before describing this balance I would like to tell a little history about my connection with aeronautical research.

There are two types of balance in common use. They are the N.P.L., and the Hanging Wire balance. The N.P.L. balance is very old and was used first by S. P. Langley of the Smithsonian Institute in the early nineties of the last century. Langley called this balance his Resultant Pressure Recorder. He placed the lateral axis (span) horizontal and measured the line of action and magnitude of the resultant pressure. I believe Orville Wright in his private wind tunnel is the only one who now takes these measurements. The N.P.L. people simply took Langley's Resultant Pressure Recorder, oriented it 90 deg. so that the span is vertical, mounted it on a point (Langley used a gimbal mounting) and measured the Lift and Drag components. The N.P.L. balance is, of course, an improvement over Langley's.

Early Aeronautic Research

I happen to know about Langley's work because near the close of the last century I did some aeronautical research work for him with a grant of money from the Smithsonian Institute. We were pioneers in those days and my particular job was to find the center of pressure travel on a curved surface in a natural wind. Of course, I got no results, as it is impossible to use the natural wind for any work requiring quantitative accuracy.

About this time I was gliding in the Chanute glider, and made hops of from 100 to 150 ft. In those days we had no control surfaces. Control in roll and pitch was obtained by flinging the legs toward the high side.

Along with this outdoor work I built the first hanging wire balance which was ever used for aeronautical work so far as I know. I tried the balance in the old M.I.T. building on Trinity Place, Boston, Mass. Any old M.I.T. graduate who reads this will remember that in the basement of the old building on Trinity Place, approximately under the office of Prof. Hayward, there used to be a duct near the ceiling. This duct was part of a ventilating system. When air was not needed above, I could turn the stream out into the room where it had a beautiful chance to get all mixed up with the mess of pipes and machinery which occupied the space. That was my wind tunnel. Prof. Gaetano Lanza was a good friend of mine and was very much interested in this work and helped me. I had two scales for weighing the lift (downward) at the front and rear edges of a flat surface and a wire for the drag. It was exactly the same idea shown diagrammatically in Monteith's book "Simple Aerodynamics and the Airplane", p. 26, first edition, put out by our government from McCook Field in 1924. Of course I got no worth while results with such a variable.

Some Personal Experiences

Shortly after this, that is in 1901, the Wrights began their flights. I became well acquainted with their work through Octave Chanute. When I founded the Boston Aeronautical Society, in 1895, Mr. Chanute was its first president, and he was a very valued friend of mine from that date until his death. I had some correspondence with Wilbur Wright about their work and two days after they made their first power flight he wrote me a long letter accurately describing just what they had done and what his hopes were. Immediately I wrote an editorial on the flight which was published in the Boston *Herald*. I felt then that the brothers were much more capable of handling the subject than I was, so for seven years I did no work in aeronautics, being satisfied simply to watch developments. In 1910 I invented a system of lateral control which did not infringe Wright's patent and which I sold to the Wright Co. in 1916. In 1914 I started some experiments which I had to stop owing to lack of funds and I am only just now completing those experiments.

I moved to Los Angeles in 1916, and in the early spring of 1917 I invented the balance which I am going to describe. I used to ride around Los Angeles in the early mornings in a Ford car with the balance carrying a model sticking out in front of the car. Needless to say, this was before the time when Fords got so thick that you can not run a street corner until you pass it. Again I found that while this balance offered great possibilities still Henry's car is not exactly a wind tunnel.

Joined C.I.T. Staff in 1919

In 1918 I joined the staff at the California Institute of Technology as Research Associate in Aeronautics and since then have had charge of the wind tunnel which they had when I came.

The balance they gave me to use was a modified N.P.L. balance, very badly modified. It rested on four knife edges and the *L* and *D* components had to be measured at different times. This in itself was enough to condemn the design, but more than that it was very badly built mechanically. I played with this for three years spending some money trying to improve it, but finally gave it up for a bad egg.

For the last two years I have been doing outside work with gliders raised like a kite and then cut loose. I have had very good success with these machines in every way. This fall however, I felt a strong need for a good balance and so turned to my invention of 1917.

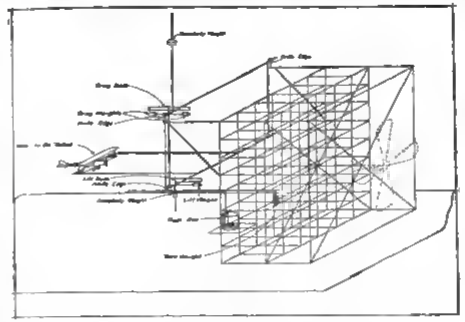
The characteristics which I wish in a balance are:

(1) The static forces must be measured simultaneously,
(2) It must be a one man balance,
(3) It must be self-recording,
(4) Pitch dynamic variables must be obtainable with the same balance and at the time the static forces are measured,
(5) It must be cheap to build.

Mr. Merrill standing beside the new air balance and wind tunnel which he developed at C.I.T.

Characteristics of New Balance

Requirements 1, 2, 4, 5 are satisfied with the balance I am going to describe and by a slight improvement I expect to satisfy No. 3 too. I will now describe the balance. Fig. 1 is a diagramatic view of the balance. Fig. 2 is a photograph of it. It is designed for model testing. I believe we have done quite enough work on surfaces. The M.I.T., N.P.L., and Göttingen Laboratories have turned out very good tests of all kinds of surfaces, but very little model work has been done and this has lead to very serious errors in design because it has been the custom for designers to take the laboratory figures on parts and sum them up for the whole machine. This has produced errors, because such a method entirely neglects the mutual interference of the parts which in some cases may be very great.



Diagrammatic sketch of the Merrill air balance and wind tunnel

In my balance the model is made with its own c.g. properly located and also preferably its pitch radius of gyration should be similar to that of the machine as accurately as the latter can be figured. The model is mounted, with its span horizontal at its outer strut points on the lateral axis, on a frame which passes forward to a cross rod. This frame has a tare weight to balance the model weight and a weight for measuring lift. This system rests on another frame, normally standing vertical, on knife edges attached to the tunnel. This latter frame also has a tare weight and allows the first frame with the model to be displaced downstream and a weight measures the drag. Because of its mounting the model has to rotate until the vector passes through the lateral axis. Photographing the model against a frame of reference gives the angle of incidence. The speed of air is measured with some type of manometer.

Operation of the Air Balance

In operation the model is set with a known setting of the elevator, the air is turned on, the weights are displaced until *L* and *D* are offset and the operator then takes a photograph of the experiment when he has a record of *L*,*D*,*V*, angle of incidence and point of application of the vector, (c. g.). This gives the static characteristics. For the pitch dynamic variable we create an artificial gust. When the gust strikes the model it starts oscillating and after the gust passes, the oscillations die out. By means of a moving picture we should be able to get the magnitude of the original oscillation and the damping time. Of course, we have to correct for the drag and the natural period of the balance.

What I like about this balance is its low first cost, and yet it works very well. My own balance is sensitive to less than 0.3 grams. I have tested crude models of pasteboard in it giving *L*/*D*'s of from 2.2 to 8.6 for different angles. By altering the air speed I have made a paper model take off, climb rapidly, level out, glide and land properly. I have also compared the tailless with the tail machine in a gust of the same type and will have something to say about this matter later.

The size of my fan is only 12 in. and my speed is only about 7 mi./hr. The variation over the testing section however is less than ± 2 per cent in spite of the tests being on the delivery side. The models I have been using are of 8 in. span. I think that even this small tunnel will give good results in qualitative work with a series of models. When the best of the series is found it can be tested in a large wind tunnel.

I hope that the younger generation of enthusiasts will build this kind of wind tunnel and do research work. Youth is the time of imagination and initiative and we need both of these things right now in this game. It is an unfortunate fact that as man grows out the period of youth his brain tends to become set and then it is next to impossible to make him see value in a new idea.

Membership in R. Aero Society

In view of doubts which appear to exist as to the qualifications required from candidates for Associate Fellowship of the Royal Aeronautical Society of Great Britain, the Council has issued the following statement as to its interpretation of the Regulations.

The Regulations provide for the election to Associate Fellowship of —

(a) Those who pass the Society's own examination, or possess an equivalent University or Technical College qualification, followed by 2 years' practical experience in the application of the sciences of aeronautics.
(b) Those who present a Thesis.
(c) Those who have very exceptional qualifications or achievements but do not possess the examination qualifications outlined in (a).

In regard to (a) the Council accepts the degree or diploma of any recognized University or Technical College in England or abroad, and excuses from the Aerodynamics paper of the Society's own Examination holders of Diplomas in Aeronautics of such Universities or Technical Colleges.

In regard to (b) the Council does not insist upon a thesis necessarily being a record of original work but require it to be of such a nature as to give an adequate idea of the Candidate's knowledge and experience in aeronautics or an allied subject applied to aeronautics.

Under the heading (c) the Council has accepted pilots of rigid airships, and airplane test and experimental pilots whose work has been, or is likely to be, of value to the progress of technical development. It also has accepted long-standing workers in any branch of aeronautics whose experience entitles them to be considered as "Pioneers." In considering applications under this heading it is not possible to lay down any hard and fast rule but each case must be considered individually on its merits.

Suggests Air Mail Postcards

"Why not have a special rate for postcards by Air Mail?" writes Harry Kirkwood from San Francisco. "This postcard weighs only one-tenth of an ounce, yet it costs 24 cents to send it across the continent by Air Mail. That is at the rate of $2.40 per ounce, $38.40 per pound, $76,800 per ton.

"Postcards are the one class of mail on which the Air Mail service can make large profits at reduced rates. But this business will not develop until the rates are reduced. They should be cut 75 per cent. Then much correspondence that now goes by slow letter would go by postcard via Air Mail.

"The Air Mail would soon be carrying a billion postcards a year at an average rate of 4 cents (two zones), giving a revenue of $40,000,000 a year from postcards alone. The Service would expand rapidly, and give us the strength in the air which we need."

Whether or not the Air Mail would soon be carrying a billion postcards per year, as Mr. Kirkwood hopefully anticipates, the idea of charging a special rate for postcards carried by Air Mail appears to be quite sound, even if the present Air Mail letter postage were only reduced 50 per cent. The suggestion deserves serious consideration on the part of the Post Office Department.

LIGHT PLANES AND GLIDERS

Edited by Edmund T. Allen

Ligbt Plane Possibilities

In reply to the proposal of the Light Plane Club in these columns, letters have been coming in suggesting many phases for such a club's activities, and also pointing to obstacles in the way of its organization. It was to feel out this interest that we solicited the ideas of readers. Is there in North America that same (or possibly a greater) interest in flying that is evidenced among the young people all over the world? News comes from Russia, with all its reputed backwardness, that the new spirit is afloat there. Gliders are being built by local groups of young people. The University students are competing in designing efficient gliders and in flying them for duration records. We have a far easier time of it here with our good materials and organized centers of information. And what is more, the spirit of creative design, of deft construction, and, most important of all, the unquenchable desire to fly are in abundant evidence. One possible organizer, a pilot, one who happens to be also an officer in the local N.A.A. organization, writes to the point: "——I think the idea presented in the Feb. 16 issue, 'For A North American Light Plane Club' will be a step toward some real development in commercial planes, and afford a great deal of pleasure to all taking an active part. There has been so much *talk* of what the future will bring in the way of light planes, that some real action is now necessary to prova what really can be done."

Some of the letters indicate that there is being discovered here, that the gateway to flying for those who enter for the love of it, lies for some in gliding. And the meet in Dayton last year showed the extent to which model building has become the gateway to practical acquaintance with the principles of flight, as of stability and control.

As the correspondent quoted points out, the time for pooling those interests is come,—and the Editor of this department solicits suggestions looking toward a constructive program which may open the way for action.

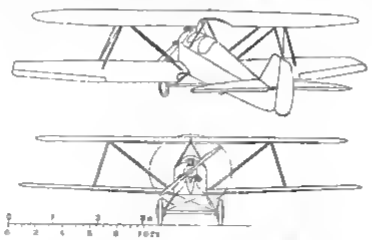
Recent Progress in Continental Europe

It is one of the principles most fruitful of economical results in experimental or developmental work to acquaint oneself continually with the progress of parallel development work in the rest of the world. In aeronautics we Americans are prone to neglect this item, and to plow painfully through the same mistakes that have been made before us by others.

The National Advisory Committee for Aeronautics (R.3431, Navy Building, Washington, D. C.) maintains a foreign office and a representative in Europe for the express purpose of keeping us informed concerning all the development work occurring on the other side. This material is published and may be obtained by anyone interested. The most recent addition to their list of publications is a Technical Report (No. 301) on "The Light Airplanes of France, Germany, Italy, Belgium, Holland, Czechoslovakia, and Lithuania." It will be remembered that two former N.A.C.A. reports gave light plane builders in the United States wonderfully concise and well formulated information and drawings of the English light planes which competed at the single seater and the two seater light plane meets respectively. There was a surprising demand for these reports, echoing in a small way the awakening of interest in light planes in this country. The new report contains descriptions of all the outstanding light planes of the countries mentioned, with three view drawings, dimensions and comparative data concerning structural weights and performance. Until this material is put in some different, perhaps more permanent form, those who are interested will find these reports of inestimable value.

The H1 Biplane

To those who are firmly convinced that the monoplane is the ultimate and last word in light plane construction, the sight of this neat little biplane may be cause for reflection. It was designed and built by the Vliegtuig-Industrie of Holland for the Tour de France des Avionnettes. It is a very sturdy little sport plane and flies well with its 25 hp Anzani



Sketch from a half-tone cut of the Holland light plane with 25 hp Anzani engine

and two persons aboard. The span is 25 ft. 3 in., the overall length 18 ft. 7 in. and the wing area 150.7 sq. ft. The machines gross weight of 705 lb. gives a wing loading of 6.21 lb./sq. ft., and a power loading of 24.2 lb./hp. *Its weight per foot of span*—which is an important item usually neglected where it is most vital, namely, in the design of low-powered airplanes,—is 26 lb. per foot. This is a heavy "Span Loading" for light planes and would indicate the probability of a feeling of "underpoweredness" that is quite possibly absent in, for instance, the Daimler Lt15 two seater with a 12 hp. motor.

The Motorcycle Engine for Ligbt Planes

A tempest in a teapot seems to have been aroused over the recent letter appearing in these columns extolling the use of motorcycle engines in light planes. "No," one correspondent says emphatically, "motor-cycle engines, never again." Another dissenter develops his point of view more at length. "Have we not had enough troubles," he asks, "to have already discovered that motorcycle engines are totally unsuitable for light plane service. I know personally of twelve light plane builders who were unable to get to the races last year at all because they could not get their motorcycle engines to run, or they could not get them to stay in the engine mounting. And of those who did get to the races, only three kept their engines running long enough to get around the course, and two of these had engine trouble constantly."

This correspondent is not at all of the opinion that the engine failures were the result of inexpert engine operation. He states emphatically that company representatives were present in almost every case, and were unable to make their own engines function properly under these conditions.

Another writer points to a possible reason for this state of affairs. He says, "It takes just 25 hp. to pull a motorcycle along a road at 30 m./hr. Motorcycle engines never have much more work than this to do except in racing. After every race, if the engine holds together through the race itself,—which is very problematical,—they are thoroughly overhauled

"Motorcycle engine designers have no conception of the standards required of aircraft engines, with the possible exception of one company who frankly stated that they did not want their engines used in airplanes since they believed them unsuitable for such service. A full throttle, full power run for 50 hr. such as is required as the acceptance test on aircraft engines would be unthinkable as a motorcycle engine test."

These are strong words. But they state the case of the light plane builder with a fine economy. The same criticism could be given equally well of automobile engines, although, on account of the keener competition and enormously greater production in this field, more designing and development engineering have gone into the automobile engine than into the motorcycle engine. But what standard automobile engine even we would like to ask, has ever stood a full power 50 hr. non-stop run? The automobile engine is not hampered by weight limitations of 2 lb./hp. or even of 10 lb./hp. The airplane engine has of necessity brought the problem of reliability at maximum power to a head. And into that problem has gone the best engineering skill in the world. The result has been such engines as the Rolls-Royce aero engine, the Liberty, the Curtiss D12, and, in the air-cooled field, the new McCook Field air-cooled Liberty. For the light plane we have as yet very few satisfactory engines. Some light plane builders will continue to use motorcycle engines, and some will undoubtedly get some satisfactory operation from them. Many, however, are looking for the ideal light plane aero engine of the future.

Light Plane Club Notes

Mr. Cashman writes from Dayton, Ohio:

"I think the idea of a Light Plane Club is a step in the right direction as a means of popularizing flying and instilling into the general public what the English paper *Flight* calls the 'air feeling'."

How this is to be accomplished is the subject of much difference of opinion. Some advocate private initiative entirely. Others would have the government assist. Mr. Cashman says he believes, "The light plane should not be left entirely to the amateur. "We might well," he thinks, "copy the British Government's attitude toward the light plane. . . . In last year's competition, of the thirteen different types entered, eleven represented the best factories in the British aircraft industry, one was the product of a light plane club, and one was built by an amateur and was not finished in time for the competition. In addition to a grant or subsidy to the clubs, the government should pay a certain sum to the club for each pilot's license issued, provided the pilot was not the holder of a license within the last five years. Some such system would provide an incentive to give the more apt members of the club the earliest training.

"The English aim is—'a nation of aviators'—and they are making a good beginning by interesting the aircraft manufacturers in the light plane and by the formation of government assisted light plane clubs."

The difficulty here would be, of course, to induce the government to see it in this light. In the meantime we must operate with what means we have.

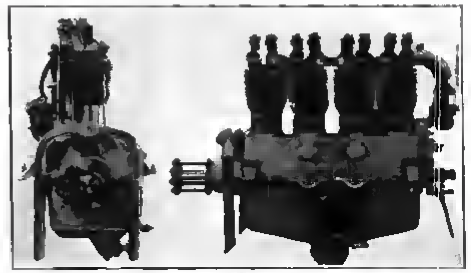
80 Cubic Inch Limit Retained for Ligbt Planes at Meet

The National Aeronautic Association has announced that the 80 cu. in. limit imposed on the engine displacement for light planes to compete in the 1924 Air Races will be retained for 1925. The announcement does not place a limit upon two-seaters but states that 160 cu. in. would receive favorable consideration should the occasion demand such a class. Now that 60 hp. has been obtained with 160 cu. in. engines, and that without pushing them particularly either in r.p.m. or in mean effective pressure, one wonders what will happen to light plane development if its direction is determined by the 160 cu. in. class. There are several two-seater light planes being built at the present time with 80 cu. in. engines. It is to be hoped that they will be completed and successfully flown in the light plane races against the less handicapped single-seaters.

The "Cirrus" Engine

The 60 hp. "Cirrus" is designed to meet the requirements of school and privately owned machines and to lift the light airplane from the experimental stage into a sphere of practical utility. The first machine to be fitted with this engine will be the new DeHaviland two-seater the Moth (DH60).

The designer of this engine is Maj. F. B. Halford, who is well known in connection with the design of the B.H.P. and Siddeley Puma engines and is manufactured by the Aircraft Disposal Co. Ltd. of England. Reliability has been the chief objective, combined with the introduction of progressive features. Special consideration has been given to accessibility and low cost of maintenance.



Propeller-end and exhaust side views of the Cirrus 60 hp. engine for small airplanes

It is a four cylinder, vertical, air-cooled engine as shown in the accompanying views. The total weight is 260 lb. The engine is rated at 60 hp. at 1800 r.p.m. with a maximum of 65 hp. at 2000 r.p.m.

An impulse magneto and hand starting device provide for ease in starting, the hand starter being arranged to operate from the pilot's cockpit. It is fitted with Detachable aluminum cylinder heads. Direct airscrew drive. Exhaust heated muff on induction pipe. Self contained oil system.

New Members in R. Ae. Soc.

The following Fellows and Foreign Members have recently been elected in the Royal Aeronautical Society, England: Fellows: Maj. J. C. Stewart. Associate Fellows: R. V. de Aboim, K. W. Berger, E. C. Gibbons, J. D. Haddon, Maj. H. Hemming, F. A. Kerry, G. Lyon, J. S. L. Oswald, C. A. Pike, C. J. Sanders, Maj. G. H. Scott, C.B.E., A.F.C., Prof. O. S. Sinnatt, S. O. Smith, C. A. Wright. Foreign Members: H. Faillant, A. P. Loening, W. A. Yackey.

Georges Dreyfus Cup

Georges Dreyfus, who is well known in French Aeronautical circles offered a prize to be competed for by French and Belgian aviators for the best motorless flight. A cup worth 5,000 francs and two cash prizes of 10,000 francs were offered but to date have not yet been competed for so that the prize will be offered again this year. This prize is offered to the pilot who within the year covers the greatest distance over 25 km. and returns to his starting point.

AIRPORTS AND AIRWAYS

Long Island News

The focus of interest for the flying fraternity of Long Island is the two new ships which are being tried out for experimental service with the Air Mail. The Air Mail is not conducting a regular competition for new planes but have let it be known that if they could find a plane which was better than the DH4 that they might buy a few. The Post Office Department has given out no definite specifications, except that they want a cruising speed of over 100 mi./hr, good maneuverability and close vision. The two ships which are being groomed at Curtiss Field are quite different in their general outline but judging by the similarity in many of the gadgets, auxiliaries and appliances, both constructors must have been inspired by people who had pretty definite ideas as to what they wanted. The planes are being given high and low speed tests, ceiling tests with full load (1000 lb.) and a cross country run of 100 mi. to test cruising speed and gasoline consumption. If these tests show that the machines are the kind the Air Mail desires they will be sent with several other experimental planes to Chicago where they will be put on a trial run under service conditions. The observers for these preliminary tests are to be Prof. Edward P. Warner, Capt. J. E. Whitbeck, Superintendent of the Eastern Division of the Air Mail and E. C. Richards, Superintendent of the repair depot at Maywood.

The Curtiss ship is called the Carrier Pigeon and is being flown by the head of the Curtiss Field staff, the popular Casey Jones. The Aerial Service Corporation's plane named the Aerial Mercury is being tested by Harvey Mummert of light plane fame. Mr. Mummert was the chief engineer in designing the new ship and is making the test flights to find out by personal experience whether it will do what he designed it to do.

The general appearance of the Mercury is rather pleasing but it is difficult to get in 50 cu. ft. of mail compartment without making the fuselage somewhat bulky. The Mercury has a triangular fuselage faintly reminding one of a distorted S.V.A. The pilot can easily see over the side without having to lean out. The Carrier Pigeon is commonly called the "flying truck," though the "flying express car" might suit it better. The fuselage is very high and narrow and angular in appearance, but the pilot not only gets good visibility directly down without leaning out of the cockpit but he is placed so high that he can see down over the lower front wing and can see down at quite a good angle even directly over the motor. Both planes have been built to get simplicity and ease of maintenance. The Curtiss product has all the control surfaces interchangeable, while the Aerial Service Corp. has interchangeable surfaces except for the rudder.

The Mercury has many nice little gadgets in the cockpit for the benefit of the pilot. The rudder pedals are adjustable for height and depth. There is a by-pass from the exhaust which furnishes hot air to the cockpit when the weather is cold, a trick safety belt around the shoulders allows the pilot free movement but after a certain point holds him back through heavy shock absorbers so that his head can not strike against the dash or control stick in case of a crash. The control stick is made of aluminum, so that it will not affect the compass. A button on the control stick switches on the instrument lights without taking the hand off the control stick. The flare box has a device to prevent careless release of the flares while in the hangar. All these little details show careful planning and a knowledge of what is wanted.

All the controls are easily inspected by trap doors let into the bottom of the floor and wings. The tail skid is entirely externally mounted so that it can be easily inspected or replaced. A very neat one man dolly has been built for the plane which seems to work well and should save time and labor.

Both the Carrier Pigeon and the Mercury look like real airplanes and certainly are an advance over the present mail ships. Probably no two pilots in the Air Mail will have exactly the same opinions about the various ships offered as familiarity has bred a real affection for the old DH's. It is hoped that by this time next year that the mail will have in operation a ship which is a real improvement.

Airway Information

The following information concerning landing fields for airplanes in the Puget Sound area has been received from the commanding officer, United States Fleet Aircraft Squadrons Battle Fleet, V. F. Squadron 2, through the Chief of the Bureau of Aeronautics and the Chief of the Bureau of Navigation.

Lake Sammamish.—On the north shore of Lake Sammamish, eastward of Lake Washington and toward Redmond, are numerous pasture lands which are suitable for emergency landings. The country in this neighborhood is open land, with forests and hills to the north and west.

Approx. position 47° 40′ N., 122° 05′ W.

Issaquah Field.—The landing field at Issaquah is approximately 2 mi. northwestward of the town. It is bordered on all sides by a rail fence and has a large tree in the southwest corner. The field is distinguishable due to the fact that it is westward of the road leading north from Issaquah and is the largest field in the vicinity. The ground is covered with thick matted grass and has a number of long rolling depressions which cause difficulty in landing and which bring the rating of the landing place down to an emergency field. The prevailing wind is from the northwest and the best approach to the field is from the south.

Approximate position of Issaquah, latitude 47° 30′ N., longitude 122° 00′ W.

Renton.—On the southern shore of Lake Washington, southward of the town of Renton, is the golf course. Emergency landings can be made on either side of two fairways extending east-west. The country is rolling and partially wooded. Southwest of the golf course are numerous pasture lands having clear approaches, which might be utilized in an emergency.

Approximate position of Renton, latitude 47° 30′ N., longitude 122° 12′ W.

U. S. Coast Survey Chart 6460.

Enumclaw and Buckley.—The best landing field in the vicinity of Enumclaw and Buckley is a pasture extending east and west about halfway between the two towns. The field is westward of the railroad track connecting Enumclaw and Buckley and is bordered on all sides by a rail fence. The best approaches are from west and east. The prevailing wind is from northwest. The ground is smooth and level and is covered with grass. The field is about 1,800 ft. long.

Approximate position of Enumclaw, latitude 47° 12′ N., longitude 122° 00′ W.

Buckley.—A second field in the vicinity of Buckley is located just westward of the town on the White River. The river winds about the field, forming its northwestern, northern, and northeastern boundary. The field is a pasture covered with grass. On the south is a border of low trees. The prevailing wind is northwest. Approaches may be made from any direction. The field is smooth and an excellent landing place.

Approximate position of Buckley, latitude 47° 10′ N., longitude 122° 00′ W.

Notice to Aviators, No. 3 1925

German Air Services During 1924

Although the development of air services in Germany has been retarded by the restrictions of the Treaty of Versailles and by later interpretations of that Treaty, the year 1924 witnessed a marked improvement in civil aviation in that country, Vice Consul Paul Bowerman, Berlin, advises the Department of Commerce. The following tables are based on statements of the two principal German air service companies, the Junkers Luftverkehr A. G., and the Deutscher Aero-Lloyd.

	Number of flights 1923	Number of flights 1924	Kilometers flown 1923	Kilometers flown 1924
Junkers	3,554	8,743	870,884	1,322,723
Deutscher Aero-Lloyd	3,603	3,187	584,087	1,017,845
Total	7,158	11,932	1,425,661	2,330,668

	Number of passengers 1923	Number of passengers 1924	Freight baggage (kilograms) 1923	Freight baggage (kilograms) 1924	Mail (kilograms) 1923	Mail (kilograms) 1924
Junkers	8,148	12,874	23,750	68,755	5,700	[illegible]
Deutscher Aero-Lloyd	2,428	8,106	63,800	68,813	2,711	8,000
Total	10,572	20,980	87,550	137,568	8,411	24,330

Two highly successful experiments in regular night flights were made by the two concerns, the Junkers service from Berlin to Stockholm, and the Aero-Lloyd from Berlin to Copenhagen. Both concerns have also inaugurated regular winter-schedules for 1924-1925 for the first time. The construction of all-metal planes, designed solely for the transportation of freights, mail, and baggage, is contemplated as soon as their unrestricted use is permitted in Germany. Another important step forward in the improvement of German air-services was the arrangement with the Federal Railways, approved Oct. 16, 1924, whereby air passengers were permitted to forward their baggage by train simply upon presentation of their tickets. This arrangement holds good, of course, only within the country.

Russian Airway Expansions

A great expansion of the Russian air transport companies is planned for the summer of this year. The Dobroljot will open a new section from Almaat to Kultscha on the Chinese border, using Junkers machines. A representative of the same company is making preparations for a line from Jakutsk to Irkutsk in the Black Sea Province. These extensions are in line with the project of a linking up of Moscow with Tokio and Peking. The principal use of the lines at present is for propaganda purposes.

Italy to Australia Flight Planned

The Italian Air Department announces that a flight from Rome, Italy to Sydney, Australia, via Japan, and return will be made in the coming spring by Commander Francesco de Pinedo, chief of the Italian air staff. He will fly a Savoia 16-ter flying boat with a 400 hp. engine, which will have a 10 hr. cruising range. The start will probably take place early in May.

Commander Pinedo's itinerary is from Rome to Egypt via Crete, then along the Red Sea and the southeastern coast of Arabia to Persia, India, Burma, the Straits Settlements, French Indochina, China, Japan and from there by way of the Pacific islands to Australia. The length of the trip is approximately 33,000 mi.

Commander Pinedo is one of Italy's foremost seaplane pilots and he possesses particular experience in long sea flights.

French to Use U. S. Air Mail

Orders have been issued by the French Government coordinating the French postal services and the air mail service between New York and San Francisco. The innovation promises to be of great interest to international business houses as it means a saving of from two to three days in the delivery of a letter along the Pacific Coast.

Letters for the new service are required to be plainly marked "New York-San Francisco Air Mail Service" and should bear additional French stamps to the amount of two francs for every 20 grams or fraction thereof for the New York-Chicago section of the service, and additional two francs for each of the Western sections, terminating at Cheyenne, Wyo., and at San Francisco.

Efforts toward the establishment of the through service from Paris have been made for some time by the Aviation Committee of the American Legion, Paris Post No. 1, which has worked with Mr. Sidney B. Veit, Chairman of the Foreign Relations Committee of the National Aeronautic Association, to this end. The Legion Committee, composed of R. C. Wood, Chairman, and Colonel Charles D. Westcott, pointed out to Colonel Paul Henderson, Assistant Postmaster-General in charge of the Air Mail the great saving in time such a connection would offer. Bills of lading and Consular invoices can not be got ready until a day or two after the shipment of goods has been made. By employing the Air Mail, however, this discrepancy may be overcome as the invoices will arrive at about the same time as the goods.

Wichita Maiden Tested

C. S. Seymour, president Wichita Chapter N.A.A., congratulating L. S. Stearman on the performance of his new design

The latest design of Lloyd Stearman was tested on March 13 at Wichita. This plane was built by the Travel Air Manufacturing Co. and is the first of a series to be placed on the market. The tests were observed by the Wichita Chapter of the N.A.A. and certified by them. The average of three speed trials over a measured course with pilot and one passenger was 00 mi./hr. Then the ship was given a series of tests with an overload as follows. 1119 lb. of useful load were taken aboard and the plane took off after 451 ft. run and climbed to 500 ft. in 2 min. 3 sec. The climb with pilot and one passenger was 1000 ft. in 1 min. 6 sec. As this plane is equipped with a 00 hp. OX5 engine, these figures show this model to be very efficient. A full description of this new design is being prepared for AVIATION and will appear in an early issue.

Huntington News

By A. B. McMullen

Two more men have been added to the personnel of the Shank-McMullen Aircraft Company. Both are experts in their respective lines and will help to increase the service that the company has always endeavored to give its customers.

E. O. Guser has leased a large tract of land on the Eastern outskirts of Cincinnati and is converting it into a first class flying field where he expects to operate a number of planes this summer. The field will be known as the Queen City Air Park.

Jimmie James, ex R.A.F. pilot, has accepted a position with a large company to dust cotton in Georgia this summer.

A Flying Family

The Montee family of Clover Field, Santa Monica, Calif., claims to be the largest family of pilots, as it includes the father and three sons. The father J. W. (Daddy) Montee is 62 years of age and qualified as a pilot after he was 60. His sons, Harold, Ralph and Kenneth are engaged in the operation and construction of airplanes at Clover Field. J. W. Montee was recently complimented by General Patrick on his becoming a pilot and his sons.

Cleveland and Washington News

By Cy Caldwell

The SC1, Navy three-purpose plane, built by The Glenn L. Martin Company has been under rigid trial by the Navy Department at Anacostia, D. C., flying every day for two weeks. The Martin Company are turning out one plane a week until the tenth plane is delivered, when production will reach two a week. This schedule will be maintained until the seventy-five planes are delivered

* * *

I was in Washington acting as nurse-girl to this SC1 and was thus privileged to witness the House Committee's Aircraft Investigation, now known as the Battle of the Potomac It was a furious war Anti-aircraft shells exploded everywhere—except where the target was. Valiant shouts of "You're another!" and "So's your old man!" were hurled back and forth

But that wasn't the worst of it Every afternoon a General would get up and verbally sink a battleship No sooner would it hit bottom than a couple of Admirals would get to work and haul it up again. There it would be when the Committee woke up in the morning, floating calmly, waiting to get sunk some more—and the Admirals all ready to go after it.

Naturally, this procedure gave no satisfaction to anyone For instance, some old line officer would wander in hoping to see the utter annihilation of a couple of bombing planes; instead of which up hops a General and sinks a battleship on him, spoiling his whole day Or two airplane enthusiasts, say, dash in to see the battleship sink, and what they see instead is how the two indefatigable Admirals have just hauled the ship up and pumped her out for the fifth time. The Committee could see that everyone was getting peeved so they made the ruling that Generals were only allowed to sink battleships on Mondays, Wednesdays and Fridays; while Admirals could only haul them up Tuesdays, Thursdays, and Saturdays After this considerate ruling an enthusiast for either side could pick his day, have a whale of a good time at the enemy's expense and go home singing happily to himself

* * *

Henry Berliner and his new helicopter are playing Anacostia Air Station, or rehearsing the act, I should say, with Lieut Harold R. Harris in the star role of pilot—first flight will be soon. I know even less about helicopters than I do about other matters, but it seems to me this helicopter has a good chance of being successful It looks reasonable. And Berliner is one of those quiet chaps who smile frequently and talk infrequently, and those kind of men as a rule accomplish things As for Harris, after flying what "the lad Grey" calls the world's worst airplane and getting away with it, a mere helicopter should be duck soup to him Personally, I'm betting on this combination to succeed I think it will fly higher, further and faster than any other helicopter yet built If it does I'll be highly delighted for it will be the first time I've ever guessed right on any subject.

Yackey Notes

On Feb. 17 Pilot Hans Hoyte in a Yackey Sport flew the first pictures to arrive at Chicago of the Cave City tragedy and completed his flight during two hours of darkness. Another Pilot has been added to the organization—H F Cole who has been in the flying game ever since learning to fly in France in 1917 for the Royal Flying Corps. The past five years he has spent in "Barnstorming" and other commercial aviation with headquaters at Minneapolis and, later, Chicago He will be remembered by some for winning second place in the "On-to-St. Louis" Race in 1923 During the past week Pilot Cole made delivery of pictures of the Inauguration of President Coolidge to St. Louis from Chicago after the pictures had been wired over the Bell Telephone lines from Washington. A second lot of pictures were also delivered to St. Louis by Pilot Bob Ruddell on the same day. The Yackey Aircraft Company has now taken over Checkerboard Flying Field and are erecting a new 50 ft. x 50 ft. hangar, 20 ft. x 40 ft. shop and 50 ft. x 50 ft. warehouse These additional facilities will take care of the ever increasing business that is coming in and a class of twelve students are taking advantage of every day of good weather to get an early start in their year's flying. Orders for the Yackey Sport plane keep coming in and a new 6 passenger Breguet will be out on the line next week.

Mt. Vernon, Ill.

By Arthur C Brewn

The Mt Vernon fliers have leased a 35 acre field two miles west of Mt Vernon, adjoining the paved road. The field is a very good one being almost square and has a four way take off with low approaches on all sides. It is hard and can be used in all kinds of weather. Transit fliers are welcome at all times. Gasoline and oil will be available on the field.

The Chamber of Commerce of Mt. Vernon have cooperated with the fliers and have had the name "Mt Vernon, Illinois," painted on the roof of one of the high buildings down town. This can easily be read from 4,000 ft. and makes a dandy land mark for transit flyers.

Lieut. Arthur C. Brown, A S O R C. is in charge of the fliers. He is well known through out Southern Illinois, as this makes his fourth season in that territory. He is at the present flying an upper wing Canuck with Hisso engine Ralph M. Maxey is flying the Laird-Swallow, in which they have installed an OXX6 engine. G. A. Barton is away on a trip and expects to bring back a Hisso Standard. This will give the fliers three good fast ships, which will meet the flying public's demand along any line.

The High Smoke Stack at Langley Field

In a recent issue mention was made of the fact that a smoke stack approximately 80 ft. high had just been erected at the Post Machine Shop at Langley Field, Va. It appears that this stack is sufficiently removed from the line of flight of airplanes, either on the take-off or upon landing at Langley Field to constitute no menace to the safe operation of visiting aircraft provided existing orders to properly illuminate this obstacle during the hours of darkness are carried out.

Detroit

By Virgil Simmons

The situation in Detroit aviation circles, and indeed as it appears for the entire Country, is most promising and is believed that the combination of a general favorable financial condition and an incalculable increase in ranks of our air minded citizens, presages a year of greatly increased activity in all phases of commercial aviation, and should provide a real stimulus for progress in the solution of the problems of aeronautical engineering.

The recently instituted Thursday Noon Lunch, at the Union League Club, for all who are interested in Aviation, is doing great work in rendering active assistance to local Aviation projects and providing a time and place for periodical meetings. I believe with Charles E. Planck, Skytraffic Editor of the Detroit Free Press, that the power and influence of this group will rapidly increase provided its affairs are kept open, and the principal legibility provision remains simply a vital interest in Aviation

Major Lanphier, Commanding Officer of Selfridge Field, to my mind, has proven conclusively, by the recent winter maneuvers of 1st Pursuit Group at Camp Skeel, the correctness of Gen. Mitchell's contention, that up-to-date Aircraft can be completely serviced in the field, far from the base of operations, without dependence upon surface transportation. I wish to point out, particularly to those who are deeply interested in an adequate air defence, but who are not in a position to definitely familiarize themselves with Air Service Maneuvers, that the cause of failure on the recent Dawn-to Dusk flight from Selfridge Field to Miami, by twelve Ships of the 1st Pursuit Group, was due primarily to inadequately kept Air Intermediate Depots, insufficiently maintained with competent and trained personnel, and was not the fault of ships or pilots, for the Curtiss Pursuit PW8's are wonderful fighting ships, and the pilots, highly trained and skilled, are equal to, and in my opinion excell, any similar group in any service.

UNITED STATES AIR FORCES

U. S. ARMY AIR SERVICE

Army Air Orders

First Lieut. George W McEntire, A S., Kelly Field, to San Francisco, sailing on transport May 14 for Hawaiian Islands.

Sec. Lieut. George Anthony Bieber, A S., Brooks Field, transferred to Signal Corps, Eighth Corps Area.

Sec Lieut. Donald D. Rule, A.S., Brooks Field, transferred to Coast Art Corps, sailing June 17 from San Francisco for the Philippine Islands.

Resignation of Sec Lieut. Daniel Allen Terry, A S., as an officer accepted.

First Lieut. Michael E. McHugo, A S., Kelly Field, to New York City, sailing on April 1 for the Canal Zone.

Following officers A S relieved from assignment and duty Brooks Field and will report to Commandant A S Adv Fly Sch, Kelly Field First Lieuts. Orvil A Anderson, James M Gillespie, Sec Lieuts John R Armstrong, Carl J Crane, Glenn L Davasher, Howard G Davidson, Dean S Fillthrope, James W Fletcher, Lawrence C Elliott, Irving B Greene, Paul R Greenhalgh, James Hewins, jr., John L. Hitchings, Leslie P Holcomb, Lloyd E Hunting, Bryan M Jacobs, Harold J Johnson Harold C King, William D. Old, Earle E Partridge, David M Ramsey, Robert R Selway, jr, Luther S. Smith, George H Steel, George C Stewart, George A Whatley, Thomas D White, Leslie F Young.

Spec. Or No 4 amended to assign First Lieut. Frederick A. Johnson, A S, to San Antonio

Spec Or No. 291, instructing First Lieut. Carlton F Bond, A S in proceed from Aberdeen to New York City and sail for Philippine Islands revoked

First Lieut George C Lundberg, A S, Kelly Field, to San Francisco, sailing June 17 for Philippine Islands

First Lieut Erik H Nelson, A. S., McCook Field, to temporary duty Washington and thence to Seattle for temporary duty at the Boeing Aircraft Corpn to familiarize himself with certain duties, upon completion of which he will proceed to Santa Monica for duty as Prod. Manager A. S, 9th Corps Area, at the Douglass Aircraft Co

First Lieut. Graham M St John, A. S., Brooks Field to Kelly Field

First Lieut. Charles R. Evans, A S., Fort Sam Houston to Kelly Field

Following enlisted men A S from stations indicated to Brooks Field: Privates Philip B Simon and Alfred Smith, Aberdeen, Troy S Holliday, Wilbur Wright Field, Joseph Clare Sniper, Jesse Tanner, Selfridge Field, Vernon T Benest, Basil B Bower, Gerald J Haltan.

Following enlisted men, organization and station indicated, relieved from present duties and transferred to A S, grade of private, Brooks Field. Privates George W. Binckley, Meteor Station, Selfridge Field, Harold F Harrison, Det Serv Co, Meteor Station, Scott Field, Harold H Strickland, Det Serv Co Nn 6, Meteor Station Scott Field, Clifford J Hope, 2nd Signal Troop, Fort Sam Houston, Staff Serg John W Denny, First Sig Troop, Fort Bliss.

Resignation of Sec Lieut. William John Renn, jr, A S., as officer accepted

Sec. Lieut. Harry William Coon, A. S., Kelly Field, transferred to Camp Alfred Vail.

Resignation of Sec Lieut. Oscar Arthur Proehl, A S., as officer, accepted

Sec Lieut Robert A. Ellsworth, A. S (Field Art.,) Brooks Field, to Fort Sill

First Serg John M Rale, A S, Kelly Field, retired

First Lieut. Roger S McCullough, A. S., Kelly Field, to San Francisco, sailing May 14, for Hawaiian Islands.

Capt Calvin E Giffin, A S, from Hawaiian Dept to Crissy Field.

First. Serg Lee Robinson, A. S., Langley Field, transferred in grade of Private to detached enlisted men's list.

Sec Lieut. Arthur Gillette Watson, A S, promoted to grade of First Lieut

Sec. Lieut. James E Poore, jr, A S, Brooks Field, transferred to Signal Corps, Camp Alfred Vail.

Sec. Lieut. Paul Albert Packhardt, A S, Brooks Field, transferred to Inf., Fort Sam Houston.

Sec. Lieut. Frederick August Schauss, A. S., Res, to active duty, from Takoma Park, Md., to Selfridge Field, reverting to inactive status June 14

Sec. Lieut. Leslie A Skinner, A S, Brooks Field, to Scott Field.

First Lieut. Leland R Hewitt, A S, Brooks Field to Maxwell Field

First Lieut. Rex K Stoner, A.S, Langley Field, to Walter Reed General Hospital, for observation and treatment

Sec. Lieut Walter D Bute, Inf, Fort Sam Houston, detailed to A S Prim Fly School

First Lieut. Christopher William Ford, A S, promoted to grade of Capt

Sec Lieut James Frederick Howell, jr, A S, Brooks Field, transferred to Inf, Fort Sam Houston

Sec. Lieut Ralph Arthur Koch, A S, Brooks Field transferred to Inf, Fort Sam Houston.

Following enlisted men, A S., to A S Prim Fly Sch., Brooks Field, from organizations and stations indicated Staff Serg William D Croy, 10th Obs. Squad., Fort Riley, Staff Serg Curtis A Harvey, A S Tech Sch Detch, Chanute Field

Maj. Rush B Lincoln, A S, Washington Barracks, to duty Wer Dept. Gen. Staff

Sec. Lieut Henry August Frese, A S Res., Kelly Field, to active duty, reverting to inactive status March 30

U. S. NAVAL AVIATION

Navy Air Orders

Lieut Harold A. Elliott, Ret., upon discharge N Hosp, Great Lakes, to Nav Air Factory, Phila.

Lieut. (jg) Harold Coldwell, Nav Air Sta, Pensacola, to U S S Sirius

Lieut. Wilbur V Shown from command U S S S-17, to Nav Air Boeing Airplane Co., Seattle

Lieut Gordon Rowe, Nav Air Sta., Pensacola, to Aircraft Sqds., Battle Flt

Lt. (jg) Melville E Eaton, Nav Air Sta, Pensacola, to U S S. Parrott.

Lt (jg) John B Cattermole (SC), Aircraft Sqds., Battle Flt., to treatment Nav Hosp., San Diego.

Boen. Grover C Gittins, Nav. Air Sta, Lakehurst, to U S S Partridge

Pay Clk Crawford T Folsom, Nav. Air Sta., Pensacola, to Aircraft Sqds., Battle Flt

Pay Clk Rufus Hendon, Aircraft Sqds, Battle Flt, to Nav. Hosp., San Diego, for treatment

Lt. (jg) Calvin M Bolster, det Nav Air Sta, Lakehurst, to Phila.

Lt. William J. Hart, det Insptr Nav Aircraft Corp, Cleveland, to Engr Submarines U S.S. Argonne.

Lt Lawrence B Richardson, det. Nav Air Sta., Pensacola, to Insptr Nav Aircraft, Glenn L. Martin Corp., Cleveland

Publisher's News Letter

Rubber battleships—yes it was proposed seriously by a well informed friend who visited our office recently. We were told that if the navies of the world were to protect their battleships from aircraft bombs that some such change would have to be made. Rubber blisters, it was suggested, would take up the shock of the concussion from exploding charges and the claim that a new offensive weapon has always met its defensive protection would again be substantiated. We were interested, of course, and the equally important use of rubber sides—that of causing other missles to bounce off, also occurred to our credulous mind. But unfortunately our hopeful informant returned in a few days and told us the sad news. It appears that on further investigation he learned that rubber would not work in this way as its coefficient of contraction is too slow. Thus, another hopeful idea was added to the haven of blasted hopes.

* * * *

Those who have been looking for a leader of aeronautical thought in Congress would not be very observant if they did not keep their eyes on Senator Bingham of Connecticut. He has all the qualifications. He was a pilot during the War. He knows how to write, as those who have read his book, "An Explorer in the Air Service" have learned. He knows the inside story of the treatment of airmen by the Army during and since the War. He is a trained instructor and knows how to marshal his facts for intelligent presentation, a facility that be acquired while a professor at Yale. He is a forceful speaker. He is successful politically having been elected Governor of Connecticut and Senator in the same year. But perhaps of greater importance is the fact that he is one of the "administration" group in the Senate. With these qualifications he is bound to take an important part in the consideration of all aviation matters during the next four years. Coming, as he does, to a position of great strategic importance, without any previous alliances to handicap him, it is not without the book to expect to hear that he has become one of the most important factors in government aviation circles. He has written for AVIATION and been one of our valued subscribers for many years.

* * * *

Our valued contemporary *Aero Digest* takes its pen in hand to take issue with one of the other monthlies. It writes under the caption "Dusty Glasses."

"We do not understand why a 'standard aero publication' that is entering its 'sixth year of existence' should make editorially the following acknowledgments:

" 'Your circulation is not broad enough'

" 'So long as the aviation magazine has a circulation broad enough to reach the little family immediately interested . . .'

" 'The general public is still too uneducated to understand aeronautical terms . . .'

" 'The Editor of —— has long since found that the time has not yet arrived for the popular style magazine . . .'

"It is even harder to understand why, on the same page, it should suggest that other magazines follow its example.

"Wipe the dust from your glasses, fellow struggler in the field, and you may be able to see that the time has long since passed when advertisers felt obligated to place copy on a sympathetic basis in either 'official' or 'semi-official' trade 'organs.'

"If the Editor of this 'standard aero publication' would devote to the task of making his own magazine 'popular' the same time that he does to finding errors in the policy and administration of others perhaps prospective advertisers would not tell him that his 'circulation is not broad enough.'

"He might also learn that 'the uneducated public' will do more to advance the industry than can be done through the publication of a journal devoted to weeping and wailing. Nobody loves a cry-baby. Tears in business are a sign of weakness they also indicate that there is only a wishbone where a backbone ought to be."

All we can add is that there seems to be room for all sorts and conditions of aeronautical papers judging from the crop that has sprouted since AVIATION started, some of which however have found the soil unproductive.—L. D. G.

The Aircraft Service Directory

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BARGAIN. Curtiss seagull, three place flying boat, like new with brand new 180 Hispano and propeller. Dual control. Will give instructions free. Priced low for quick sale. Edgar E. LaParle, 734 Barry Ave., Chicago, Ill.

WANTED. Bound or unbound vol. I AVIATION. I will offer ten dollars. Write me care Box 334 AVIATION.

FOR SALE—Avro complete in perfect condition. Set up ready to fly. Equipped with 110 hp. LeRhone motor. Nine eighty hp. LeRhone props. One 110 prop. Two 130 hp. Clerget motors slightly used. Milton H. Foalks, New Egypt, N. J.

FOR SALE—2 Seaplane wing panels—and tail unit MF Type—complete JN Fuselage—including tail unit and center section newly covered—1 box fittings—cables, etc. First certified check for $150.00 takes all. V. H. Schiro, Box 1144, New Orleans, La.

Three place, 180 Mercedes standard. Has excellent performance, quick take-off, plenty of speed and good control. Practically new. Immediate delivery. Pictures and full specifications on request. Price $1,000. Lyle Hostetter, Frankford, Pike County, Missouri.

Will exchange late 1921 Stutz Sport Model—for land ship—Jennie or Standard preferred. What can you offer. O. J. Dickson, 2521 Fern Street, New Orleans, La.

WANTED—To trade for or as part payment, special built Sport Roadster for ship. Prefer Standard. P. O. Box 52, Danville, Illinois.

Pierce-Arrow-1920-Touring Car—Mileage 14,500 like new. Trade even, Prefer Standard Flying Boat—Curtiss-H. Lieut. Swanson, 1035 Lake Drive, Grand Rapids, Michigan.

WANTED. Position as aviator or engineer. Served with Lafayette Esquadrille and U. S. Air Service. Graduate of Massachusetts Institute of Technology. Capt. Wil-Lord N. Mohler, Box 333 AVIATION.

DOPE—Clear acetate $1.00 per gallon. Wood filler 5c per lb. Altman Purchasing Syndicate, 249 Broadway, Buffalo, N. Y.

WANTED—To buy or trade for upper left JN wings. State quantity on hand. Also want to trade JN lower wings with ailerons for those without ailerons. Box 340 AVIATION.

WANTED—Aviator who can do his own mechanical work, also one who can manage aviation field, who must be an A-1 pilot. Give references, hours in air and full information about yourself in first letter. Box 339 AVIATION.

LEARN AVIATION! Flying, mechanical and home study courses. Expert instructors, good equipment. A great opportunity for you. Write for free catalog. Varney Aircraft Co., Peoria, Ill.

Jenny JN4-D, OX5 in good shape, repainted, motor overhauled, also spare motor, $500.00 cash. R. E. Yonge, Jr., 18 E. Adams St., Jacksonville, Fla.

Curtiss F-Boat, in best of condition with K-6 Motor $900. Without Motor $500. P. O. Box 895, Portland, Ore.

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